bourhood of Melbourne; and the values of the wave-lengths of the spectrum lines of the alkalies, as determined by a new periodic formula.—A discourse pronounced by the late Dr. du Bois-Reymond in honour of the memory of Hermann von Helmholtz, is now published by Veit and Co., Leipzig. The discourse is a full and valuable statement of Helmholtz's life and scientific work.

THE additions to the Zoological Society's Gardens during the past week include an Orang-outang (*Simia satyrus*, ♀) from Borneo, presented by Lord Ashburton and the Earl of Crawford; a White-crowned Mangabey (*Cercocebus æthiops*, ♀) from West Africa, presented by Mr. Bernard A. Collins; a Malayan Bear (*Ursus malayanus*, ♀) from Malacca, presented by Lord and Lady Ashburton; a Nightingale (*Daulias luscinia*), British, presented by Mr. W. H. St. Quintin; three Common Boas (*Boa constrictor*) from the Teffe River, Upper Amazons; a Brazilian Tortoise (*Testudo tabulata*) from Brazil, presented by Mr. H. C. Fernando Rohé; a Phayre's Tortoise (*Testudo emys*) from Borneo, presented by H.H. the Tuan Muda of Sarawak; a Forsten's Lorikeet (*Trichoglossus forsteni*) from Sumbawa, a Blue-faced Lorikeet (*Trichoglossus hæmatodes*), two Perfect Lorikeets (*Psitteuteles euteles*) from Timor, a Phayre's Tortoise (*Testudo emys*) from Borneo, deposited; a Malbronck Monkey (*Cercopithecus cynosurus*, ♂) from Congoland, two Phayre's Tortoises (*Testudo emys*) from Borneo, two Long-tailed Grass-Finches (*Poephila acuticauda*) from North-west Australia, purchased.

OUR ASTRONOMICAL COLUMN.

MAY METEORS.—During the month of May the number of meteors is by no means considerable, the records showing quite a dearth of deduced radiant points at this season of the year. One, however, which seems to be, to some extent, prominent (*Astr. Nach.*, No. 3418), is that which is situated in the region near the brightest star in Corona. The Greenwich observers in 1866 one evening recorded no less than seven first magnitude meteors, and five fainter ones, in the course of an hour; and Mr. Denning tells us that he himself made some very successful observations in 1885. This observer is of opinion that previous observations indicate the occurrence of a special shower, and he gives, as a mean of many determinations of the positions of radiant points, the coordinates 232°·8 + 28°·6. May 18 is given as the day on which special attention should be devoted to this shower.

CENTRALSTELLE TELEGRAMS.—We have received a communication from Prof. H. Kreutz, in Kiel, which informs us that he has taken over definitely the direction of the Central Bureau for astronomical telegrams, and that in future the telegraphic address will *not* be Bureau der Centralstelle, Königlichen Sternwarte, Kiel, but Astronomische Centralstelle, Kiel. Prof. Kreutz also incloses the "Statutes" of the Centralstelle, which have been recently revised.

ACCIDENTAL ERRORS OF TALCOTT OBSERVATIONS.—From a series of observations, 500 in number, made with the object of determining the latitude of Hong Kong, Herrn Doberck (*Astr. Nach.*, No. 3418) states some interesting facts about the choice regarding magnitude of stars that will be useful to observers using the Talcott method. It has been previously found that neither the zenith distance, nor the amount of the difference of zenith distance, if within 10′, affects the error of the results; neither is the difference of right ascension, if less than 20 m., affected. Herrn Doberck suggests that these limits might with advantage be extended: it is better to "observe bright stars with zenith distance greater than 20°, difference of right ascension greater than 20 m., and difference of zenith distance greater than 10′, than to observe fainter stars within these limits, as the accidental errors of observation increase when the brightness of the stars decreases." Taking the average magnitude of each pair of stars from 3·5 magnitudes up to the 7th magnitude, he gives a table showing the probable errors of one observation for each increase of half a magnitude.

FURTHER STUDIES ON SNAKE POISON AND IMMUNITY.

PROF. CALMETTE, whose name is so indissolubly associated with the study of snake bites and their treatment by antivenomous serum, has lately published in the *Pasteur Annales*, in conjunction with his assistant M. Delarde, a most interesting and highly important series of experiments helping to elucidate the mechanism of immunity. Endeavouring to throw light upon some of the problems surrounding this highly complex question, Calmette has selected two different kinds of toxin, the one vegetable and the other animal.

The vegetable toxin was furnished by the substance known as abrine, which is the active principle of the seeds or beans of *abrus precatorius*, a leguminosa common in India and South America. It is a highly toxic material, and one milligramme suffices to kill a rabbit in forty-eight hours. Very few animals apparently can resist its action, and so far as Calmette's observations go, this immunity is restricted to hedgehogs, fowls, tortoises, snakes (*couleuvres*) and frogs. It requires as much as ten milligrammes of abrine to destroy either a hedgehog or a fowl in forty-eight hours, whilst a tortoise only succumbs after a dose of thirty milligrammes.

The animal toxin selected for these experiments was, as might be expected, serpent venom, consisting of a mixture of venoms derived from various kinds of poisonous snakes.

In the course of his previous researches, Dr. Calmette was led to believe that snakes had a charmed life against all injections of serpent venom; but he now tells us that his earlier conclusion requires correction. He has succeeded in killing Egyptian asps and a serpent native to Indo-China by injecting doses of venom three times as great as that normally present in their respective poison glands, and he is, therefore, of opinion that although reptiles do possess great powers of resisting the toxic effect of serpent venoms, yet, contrary to what he at first supposed, their immunity to this poison is not absolute.

Various hypotheses have been suggested to account for this comparative immunity exhibited by reptiles to the effect of venom, and Prof. Fraser, of Edinburgh, has attributed this phenomenon to the presence in the blood of reptiles of some anti-toxic substance. Calmette, however, has shown that, far from protecting animals from the toxicity of venom, reptile blood causes their death. Experiments in this direction were not only made with the blood derived from the liver and other organs of a *naja tripudians*, but also with injections of a filtered aqueous emulsion of these organs, but in no case was any protective action recorded.

Again, the serum of pigs, which animals in some countries are specially trained for the purpose of hunting serpents, which they devour greedily without suffering the least inconvenience from their bites, the serum of these animals has no modifying action whatever outside the body, *in vitro*, on serpent venom, and has no protective action.

Similar experiments were also made with animals exhibiting a relative immunity to the toxic action of the vegetable poison, *i.e.* abrine. It was found that whereas the normal serum of hedgehogs, which animals possess a natural immunity to abrine poisoning, can protect other animals susceptible to this toxin from its lethal effects, yet to do so effectually large quantities of the serum in question must be employed. On the other hand, fowls and tortoises, although also naturally immune to the abrine toxin, can confer, by means of their serum, no protective power whatever upon other animals against this poison.

The next question approached by Calmette was whether these so-called refractory animals can elaborate anti-toxins, and in the course of his experiments on this subject he obtained some very curious results.

For these investigations abrine only was employed, and profiting by the fact that fowls and tortoises had proved very refractory to this toxin, these animals were chosen as subjects for the inquiry.

Two fowls were given, in the course of twelve days, about eight milligrammes of abrine. Whilst, as we have seen, ordinary fowl-serum can confer no immunity from the effects of abrine poison, the serum derived from the abrine-treated fowl was possessed of immunising properties. In this case, therefore, a refractory animal, normally incapable of yielding an anti-toxic serum, had been trained by artificial means to do so. Similar experiments made with another refractory animal gave, however, quite different results, for when tortoises were treated with abrine poison, instead of their serum acquiring any protective

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property, it killed those animals into which it was injected, and by no amount of artificial training could their serum become endowed with any immunising effect. Exactly similar results were obtained with frogs, and whilst the normal blood of these animals was repeatedly proved to be quite devoid of all toxic action on mice, yet after the frogs had been inoculated with abrine, and trained to acquire an immunity beyond their brother frogs towards this substance, their blood invariably killed the mice into which it was injected. Dr. Calmette concludes from these observations that natural immunity to a particular toxin does not imply the existence of a specific anti-toxic substance in the blood of such refractory animals, and that whilst apparently warm-blooded abrine-refractory animals can be trained to elaborate anti-toxins, cold-blooded abrine-refractory animals cannot produce such anti-toxins in the normal conditions of their existence. The latter portion of this generalisation receives some support from Metchnikoff's observations of the same phenomenon in the case of tortoises and tetanic-toxin.

Prof. Calmette next proceeds to discuss the properties of serum derived from those animals in which the immunity to a particular toxin is not natural, but has been artificially induced. We are again for this purpose taken back to anti-venomous serum, and some additional information is given incidentally of the wonderful efficacy which characterises this remarkable remedy for snake bites. Perhaps one of the most astonishing properties of this serum is the rapidity with which it operates. Thus if two cubic centimetres of anti-venomous serum be inoculated into the marginal vein of a rabbit's ear, it at once confers upon the latter immunity towards snake poison. Immediately after the injection of the serum, venom sufficient to destroy an ordinary rabbit in a quarter of an hour may be injected with impunity into the vein of the other ear. Its degree of therapeutic efficiency is also extraordinarily intense, as is well illustrated by the following experiment: four rabbits are inoculated with a quantity of venom sufficient to destroy them in two hours; one of these is left, whilst the other three receive, one hour and three-quarters later, an intravenous injection of serum equal in quantity to one four-hundredth part of their weight. Whilst the unprotected rabbit dies in two hours, the other three remain in perfect health. "Voilà donc un sérum qui," writes Calmette, "d'emblée, sans reaction préalable de l'organisme, produit l'insensibilisation absolue des cellules à l'égard du venin."

Of great importance in their practical bearing are the experiments which are recorded on the *local* action of anti-abrine and anti-venomous serum respectively. As is well known, abrine was at one time used for the treatment of trachoma, but unfortunately the subsequent suppuration which attended its use was in many cases so intense and so dangerous that it had to be abandoned for therapeutic purposes.

Now Calmette has found that by applying anti-abrine serum to the local parts affected, the inflammatory action of abrine is modified in a very remarkable manner, and the hope is held out that by using this serum, and so controlling the inflammation induced by the application of abrine, this valuable substance may once more be reinstated in the therapeutics of ophthalmology. Anti-venomous serum has apparently the same local immunising action as the anti-abrine serum.

Another practical point of great importance concerning these serums is also dealt with in detail; this is the diagnostic value attaching to their use. Already Pfeiffer and other investigators have shown how, by means of serum, it is possible to differentiate between cholera and other non-pathogenic vibrios, and to distinguish the typhoid from the closely-allied *B. coli communis*. A most interesting opportunity occurred for testing the diagnostic power of anti-venomous and anti-abrine serums respectively. In India the natives frequently wreak their vengeance on their enemies by poisoning their domestic animals, and the substances selected for this purpose are those which they know will be with difficulty detected by expert analysis. Two materials are specially favoured by them for this purpose, *i.e.* abrine and serpent venom. One method of administering the poison consists in taking short pieces of wood shaped in the form of a club, in the thick end of which small-pointed rods are carefully fitted. These rods are composed of a hard greyish-looking substance. Armed with these tiny clubs, which they can easily conceal in their hands, they inflict small scratches, scarcely visible, upon the cattle, but in the production of which the pointed end of the little rod is broken off, and in this manner the cattle become inoculated with the poison. Some of these small broken-off points were sent by Mr Hankin, of Agra, to Dr. Calmette for examination. On dissolving these fragments in water and inoculating the liquid into rabbits, the latter died, exhibiting the symptoms typical of abrine poisoning. The same quantity of this liquid mixed with some anti-abrine serum produced no toxic result whatever. Thus Dr. Calmette considers his diagnosis of the poison employed as being abrine fully justified. In a somewhat similar manner the use of serpent venom was also detected.

These results open up a new avenue to the physiological detection of toxins, whether of animal, vegetable, or bacterial origin by means of serums.

Some extremely interesting experiments were also made to ascertain whether toxins and antitoxins were capable of modifying one another outside the body *in vitro*. The following examples give some idea of the results obtained. 5 cubic centimetres of anti-venomous serum were mixed *in vitro* with 4 milligrammes of cobra venom, and this mixture was injected intravenously into a rabbit. The animal remained unaffected; at the end of an hour, this same rabbit was again intravenously inoculated with 1 milligramme of venom. It died thirty-five minutes afterwards. Thus although its death was slightly deferred beyond that which was noted for the control animal, yet it succumbed almost as readily as if it had received no protective serum whatever. Again, 5 cubic centimetres of anti-venomous serum were mixed with 4 milligrammes of venom and 1 cubic centimetre of a 10 per cent. solution of hypochlorite of lime, and the whole was inoculated into a rabbit. This same animal, on subsequently receiving a dose of venom usually fatal, suffered no ill-effects at all. In this case, Dr. Calmette points out, that whilst the serum had remained unaffected by the addition of a chemical substance, the toxic nature of the venom had, on the contrary, been entirely destroyed. Hence it is claimed that when toxins and their anti-toxins are mixed *in vitro*, the former do not appear to undergo any change or modification through the presence of the latter. Therefore, either these substances can remain side by side outside the body intact, or, if any combination between them does occur under these circumstances, it is a combination which is so unstable that the application of heat or various chemical substances is able to easily bring about their disunion, restoring to either the properties they possessed before being brought into contact. Dr. Calmette, in concluding his most valuable memoir, records a large number of experiments made to ascertain what is the degree of protective power exercised by anti-toxic serums of different origin and certain liquids on animals inoculated with abrine. It has been found that broth freshly prepared, normal ox-serum, anti-tetanic serum, anti-diphtheritic serum, anti-anthrax serum, and, above all, anti-cholera serum, exert individually a decided immunising action with regard to abrine. Although the protective action of these so-called foreign serums is not so pronounced as in the case with anti-abrine serum, yet they do most undoubtedly confer a certain degree of protection. Dr. Calmette considers that this artificially induced immunity must be regarded as a condition in which the cells of the body are specially stimulated, and are thus enabled to either temporarily or permanently resist the action of particular poisons.

The mechanism of immunity will not permit itself to be lightly mastered, and it is only by the conduct of painstaking and patient inquiries, of which those just described are such a splendid example, that a comprehension of this most important as well as fascinating phenomenon can ever be hoped for.

ON THE VARIATION OF LATITUDE.[1]

AT the autumn meeting of the National Academy in 1894, which was the last occasion upon which the author asked for its attention to this subject, he presented the numerical theory of the motion of the pole, synthetically derived from the observations from the beginning of the history of the astronomy of precision up to that time, in its complete development, exactly as it stands to-day. Since then he has been interested to compare it with the various series of observations, as they have been published from time to time, not only for the purpose of verification or improvement of the numerical values of the various constants, but also to detect any additional characteristics which these later data might make apparent. These additional investigations have individually been neither extensive nor important enough to call for separate publication; since their general result has been merely a satisfactory confirmation of the

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[1] Abstract of a paper read before the National Academy of Sciences at Washington, April 21, by Prof. S. C. Chandler.

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